ABSTRACT

Title: **Nanocrystalline Intermetallic Coatings for Metal Alloys in Coal-fired Environments**

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OBJECTIVE

This research program aims to develop a high temperature corrosion resistant coating for metal alloys used in coal-fired environment. The coating consists of *nanocrystalline* intermetallic alloys, specifically iron aluminide (FeAl and Fe_3Al) and nickel aluminide (NiAl), which are well known for having superior high temperature strength and corrosion resistance. The program will develop *a new and novel process* that combines the advantages of several coating processes including thermal spray, CVD, and PTA cladding to deposit dense, thick, and phase pure intermetallics and their composite coatings. The coatings will be applied on ferritic and austenitic steels and nickel based superalloy substrates.

Overall scope of the proposed program involves: (1) The development of a new process for applying nanocrystalline intermetallic alloy based coatings, and (2) The testing of the coatings in a laboratory simulated coal-fired environment. The objective is to develop a new coating technology, that has superior corrosion resistance and creep strength at high temperatures than the existing coating technologies, for advanced coal-fired power generation systems.

ACCOMPLISHMENTS TO DATE

The initial six months of the project focused on the establishment of experimental set up. A laboratory plasma transferred arc (PTA) coating unit has been selected and acquired for the experiments. This unit is complete with powder feeder and power controls. A x-y positioning control and fixture is designed, fabricated, and installed. Initial shake-down test of the experimental set up is also complete. A preliminary coating experiment with Fe and Al powders has also been conducted. The results are being analyzed.

FUTURE WORK

The future work will follow the overall research plan consisting of:

- Concept–demonstration basic coating experiments using small coupons
- Initial evaluation and testing,
- Comprehensive process development including coating on tube samples,
- Extensive evaluations and testing.

It is expected that the first two bullet items will be complete by the end of the first year.

LIST OF PAPER PUBLISHED, U.S. PATENT/PATENT APPLICATION(S), CONFERENCE PRESENTATIONS, AWARDS RECEIVED AS A RESULT OF SUPPORTED RESEARCH,

None to date. This is a new project.

STUDENTS SUPPORTED UNDER THIS GRANT

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